

**Standard Operating Procedure
Public Water Sampling**

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Prepared: Andrew Santini

Review: Jeremy Berblinger

Approved: Luigi L. Olsen

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1.0 Overview and Application

This standard operating procedure (SOP) describes field procedures used for collection of public drinking water samples from water supply distribution systems in the Illinois River Watershed for analysis of trihalomethanes (THM) and haloacetic acids (HAA). The SOP also includes procedures used for collection of surface water samples at the raw water intake locations for the water supply systems.

THM and HAA are a group of chemicals that are produced by a reaction between inorganic and organic compounds in water (e.g., algae and organic matter) with chlorine used for disinfection to control microbial contaminants. The EPA regulates the amount of THM and HAA that can be found in drinking water because of the potential risk of increased cancer rates associated with exposure to these chemicals. The amount of THM and HAA found in a water supply is dependent on certain characteristics of the source water and of the disinfection process (Oklahoma DEQ, 2005). Samples will also be collected in order to assess the THM formation potential, and the actual presence and concentrations of THM and HAA within a water system at Gore PWA, Cherokee RWD #2, and Tahlequah water systems.

2.0 Sampling Methods Summary

Several days before sampling, field crew members will contact each water plant manager identified in Section 6 to schedule a date and time for sampling. This gives each manager enough time to contact the owners or residents where the sampling will occur. Plant managers will accompany field crew members to each sampling location. Sampling will consist of four residential or commercial locations within each of the three water supply systems, in addition to the incoming raw and finished water at the plant, for a total of eighteen locations. The raw water intakes for the three systems will also be sampled in a manner consistent with the procedures outlined in SOP 1-1 Tenkiller Ferry Reservoir Sampling. Raw water intakes will be sampled for THM formation potential, chlorophyll *a*, TOC, and alkalinity. Public water sampling locations will be sampled for THMs and HAAs. Sampling procedures are detailed in Section 3.

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THM and HAA samples must be preserved immediately after collection. Bottles provided by the laboratory already contain the necessary types and amounts of preservatives. For THM analysis, each sample will include two 40-ml VOA vials preserved with ascorbic acid and field crews will add 2 drops of 1:1 HCl per vial. Cap and invert vials to mix, making sure there is no headspace or air bubbles present. For the HAA analysis, each sample will include four 40-ml VOA vials preserved with NH_4Cl and filled with no headspace or air bubbles. THM formation potential samples do not require a preservative, but the water should be put in a one-liter amber glass container with minimal headspace. A trip blank will be provided by the laboratory.

2.1 Sampling Locations

Sample locations have been identified in three water supply systems: Gore PWA, Cherokee RWD #2, and Tahlequah. Sampling locations were determined based on the information such as historic sample results, population, number of connections, water use, etc. Table 1 provides a list of each sample location within a specific water system, along with the parameters to be analyzed. Public water samples will be collected from taps inside or outside a residential or commercial property and from sinks found in kitchens or bathrooms. These locations correspond to permitted locations regularly sampled by plant personnel. Sample locations are not to have any aerators, water purification, or water softening units as these may interfere with the analytical results. Raw water intakes samples will be collected at the same locations as those collected during the Tenkiller Ferry Reservoir sampling.

2.2 Sample Types

Water samples will be grab samples. A grab sample is defined as a single aliquot from a specific location or depth at a given point in time. This type of sample represents a single value and can, in certain instances, be used as an alternative to analyzing a number of individual discrete samples and calculating an average value.

2.3 Sample Nomenclature

In general, samples taken during the public water sampling event will be labeled according to the identification scheme: AAA-xxx-DD.

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AAA is defined by the location type. The public water supply system locations will start with "PWA", while raw water intake locations will begin with "RWI".

xxx is defined by a truncated location ID.

DD is defined by a two digit number which identifies the type of sample i.e. the original sample (01), field blank (02), or a field split sample (03).

2.4 General Supplies

The following is a list of the minimum supplies needed for public water sampling:

- Beakers/flasks
- Sample bottles with labels
- Clear tape
- Coolers with ice
- De-ionized water
- Phosphate-free detergent
- Nitrile gloves
- Data Sheets
- Field Notebooks with water resistant paper
- Handheld GPS Unit, with extra batteries
- Digital camera with extra batteries

3.0 Sampling Procedures

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3.1 Public Water Sampling

In general, the following procedures should be employed when collecting public water samples.

- Contact each plant manager prior to sampling. The plant managers will guide and accompany the field crews to each sampling location within their respective distribution system. A list of the locations is included in Table 1.
- Each water supply system will have six total sampling locations. Four of the locations are from residential or commercial properties, while the other two are of the raw and finishing/treated water at the plant.
- At sampling locations within Gore PWA and Tahlequah, allow tap or faucet to run one to two minutes, and up to five minutes for Cherokee RWD#2 locations. These run times are consistent with how each plant manager samples the locations on a regular basis and will provide a comparable dataset to historic and future results.
- After the tap or faucet has been allowed to flush for several minutes, either collect the water in a one-liter glass beaker or fill vials directly underneath the tap or faucet. Be careful not to overflow the vial as each one contains a specific amount of preservative. Two 40-ml VOA vials preserved with ascorbic acid will be filled and 2 drops of 1:1 HCl will be added to each vial for THM analysis. Cap each vial and invert to mix, making sure there is no headspace or air bubbles present. If air bubbles are present, uncapped the vials and refill so that a meniscus forms over the vial opening. Recap and check again for air bubbles. It is very important that there are no air bubbles in the vials, as these will interfere with the analytical results.
- Similarly, four 40-ml VOA vials preserved with NH_4Cl will be filled for HAA analysis. Again, cap and invert each vial to mix, making sure there is no headspace or air bubbles present.
- Since most of the sample locations are in public places, it is best to collect the water in a one liter beaker and fill vials at the field vehicle. This will help minimize disturbance to properties owners and the public.
- Store samples in a cooler with plenty of ice until shipment to appropriate laboratories. Package sample vials carefully with bubble wrap and secure inside the cooler to minimize chance of breakage during shipment.
- Record sample information in a bound field book.

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- Fill out appropriate COC forms.
- Record coordinates using a handheld GPS unit if the location varies from the original sample location.

3.2 Raw Water Intake Sampling

In addition to the public water supply sampling, the raw water intakes for each system will be sampled consistent with SOP 1-1 Tenkiller Ferry Reservoir Sampling. This includes collecting Gore PWA and Cherokee RWD#2 samples by boat, at a depth of 3 meters below the surface using a Van Dorn sampler, and Tahlequah at the surface. These raw water intakes will be sampled for THM formation potential. In general, the following procedures should be employed when collecting raw water Intake samples.

- Discrete water samples will be collected with the use of a Van Dorn sampler so that a sample from a specific depth will be collected and brought to the surface without being mixed with water from other depths.
- Prepare the Van Dorn sampler for use by rinsing it and setting the spring-loaded stoppers. Make sure the messenger is ready to be deployed.
- Lower the sampler to the required depth by counting the number of 1 meter marks on the rope that pass through the surface of the water.
- Once at the correct depth, release the messenger and allow it to fall through the water until you can feel it make contact with the sampler. This should trigger the stoppers to close, thus sealing the water inside the device.
- Bring the sampler to the surface and slowly drain the contents through the attached hose into a churn splitter.
- Keep the hose under the surface of the water in the container or direct the stream at an angle against the inside wall of the container to limit the amount of oxygenation that may occur.
- Carefully fill the appropriate sample bottles with the sample water.
 - For THM formation potential, fill 1 one-liter amber glass bottle with no preservative.
 - For Chlorophyll a, fill 1 250-ml brown plastic bottle. (If storing the chlorophyll a sample for more than one day before shipping, it will be important to filter 100 ml of water with 1 ml of $MgCO_3$ onto a glass filter pad as outlined in SOP 1-1).

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- For TOC, fill 2 40-ml VOA vials pre-preserved with HCl.
- For Alkalinity, filter at least 250 ml into a clear plastic bottle with no preservative as outlined in SOP 1-1.
- Store the samples in a cooler with plenty of ice until shipment.

4.0 Sample Containers, Preservation Techniques, Quality Control

Refer to Table 1 for the specific analyses for each sample location. At the end of the sampling day, samples will be packed and shipped in coolers to the analytical laboratories (see contact information below) depending on analyses required in Table 1. VOA vials and one-liter amber glass bottles will be bubble wrapped to minimized breakage during overnight shipment to the laboratories.

Field control samples will be collected by the sampling team to determine whether data are of suitable quality. Control samples may include trip blanks, duplicates, decontamination (rinsate) blanks, or split samples. Duplicates (either co-located or split samples) should be collected at least once for every twenty samples.

4.1 Decontamination Procedures

To ensure that samples are not contaminated by equipment or containers, it is necessary to follow certain procedures for cleaning or decontaminating equipment. All sampling equipment which is in direct contact with the sample water will be cleaned between each sample collection. Equipment which will be decontaminated include, but is not limited to: Van Dorn sampler, filtering apparatus, beakers or flasks, and volumetric measurement devices.

Procedures for decontamination are as follows:

- Rinse all surfaces with de-ionized or distilled water.
- Using a spray bottle, apply a layer of phosphate-free detergent to all surfaces.
- Rinse all surfaces again with de-ionized or distilled water until all detergent has been removed.
- If possible, rinse the container with water from the sample source.

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4.2 Laboratory Contact Information

The following is a list of contact information and shipping addresses for analytical laboratories used for the public water and raw water samples collected under this SOP. Refer to Table 1 for a list of samples that should be sent to each laboratory.

Alpha Woods Hole Analytical Labs
Eight Walkup Drive
Westborough, MA 01581-1019
Contact: Denise McLaughlin (508) 898-9220
E-mail: dmclaughlin@alphalab.com

A&L Analytical Laboratories, Inc.
2790 Whitten Rd.
Memphis, TN 38133
Contact: Jimmy Ferguson or Scott McKee, 800-264-4522
E-mail: smckee@allabs.com

Aquatec Biological Sciences
273 Commerce St.
Williston, VT 05495
802-860-1638
Contact: Jennifer Gallant or Phil Downey
E-mail: jgallant@aquatecb.com

5.0 Documentation

Bound field logbooks should be used for the maintenance of field records. All aspects of sample collection and handling as well as visual observations will be documented in the field logbooks. All entries in field logbooks should be legibly recorded and contain accurate and inclusive documentation of an individual's project activities.

6.0 Additional Information

Other contact information:

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Gore PWA
Dallas Sitton (918) 489-2636 (water plant)
(918) 774-6425 (cell)

Cherokee RWD#2
David Pulliam (918) 822-0123 (water plant)

Tahlequah
Ken Johnson (918) 456-2123 (water plant)

7.0 References

Oklahoma Water Resources Board (OWRB). 2001. *Standard Operating Procedures (SOP) for Field Sampling Efforts of the Oklahoma Water Resources Board's Beneficial Use Monitoring Program*. Oklahoma Water Resources Board; Water Quality Programs Division; Oklahoma City, Oklahoma.

Oklahoma Department of Environmental Quality (DEQ). 2005. *Water: Trihalomethane (THM) Fact Sheet*. Available online at:
<http://www.deq.state.ok.us/factsheets/water/THMfactsheet.pdf>

8.0 Revised Dates*

There are no revisions applicable to this SOP at this time.

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Table 1. An example of samples to be collected at each location in the water system. "X" denotes the parameter(s) to be analyzed for the location.

System	Location	THM ¹	HAA ¹	THMFP ¹	TOC/Alkalinity ²	Chlorophyll a ³
Gore PWA	Gore High School (teachers lounge bathroom sink)	X	X	-	-	-
	Marval Trout Resort (men's bathroom sink)	X	X	-	-	-
	City Complex (kitchen sink)	X	X	-	-	-
	Corps of Engineers Office (sink in lounge area)	X	X	-	-	-
	Treatment Plant - Raw Water (tap inside)	X	X	-	-	-
	Treatment Plant - Finished Water (sink in lab)	X	X	-	-	-
	Raw Water Intake	-	-	X	X	X
Cherokee RWD #2	Maurice Johnson (kitchen sink)	X	X	-	-	-
	Keyes Fire Dept. (sink in lounge area)	X	X	-	-	-
	John Bates (bathroom sink)	X	X	-	-	-
	Jimmie Houston Store (usually from men's bathroom sink, but both bathrooms closed -- look from sink behind counter)	X	X	-	-	-
	Treatment Plant - Raw Water (outside tap)	X	X	-	-	-
	Treatment Plant - Finished Water (sink in lab)	X	X	-	-	-
	Raw Water Intake	-	-	X	X	X
Tahlequah	Dano's (tap on side of store)	X	X	-	-	-
	E-Z Mart (sink inside store)	X	X	-	-	-
	WPC Plant (bathroom sink)	X	X	-	-	-
	Welling Store (tap on back of store)	X	X	-	-	-
	Treatment Plant - Raw Water (tap outside)	X	X	-	-	-
	Treatment Plant - Finished Water (sink in lab)	X	X	-	-	-
	Raw Water Intake**	-	-	X	X	X

Notes:

1 - Alpha Analytical

2 - A&L Analytical

3 - Aquatec Biological Sciences

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